

# Setting up a Linux PXE server and integrating clients

## HOWTO



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# Abstract

This HOWTO describes how to set up a Red Hat Linux 8.0 Pre-boot eXecution Environment (PXE) server and how to integrate a Red Hat Linux 8.0 client with the PXE server. Additionally, this HOWTO explains how to use Linux images on a PXE server and how to configure a client for PXE.

## Text conventions

This HOWTO uses the following conventions to distinguish elements of text:

Menu options, Command names, Dialog box names, and Screen names

These elements appear in initial capital letters and may appear in boldface for emphasis.

User input (commands to be typed)

User input appears in a different typeface and is highlighted in gray.

Scripts and files

The content of the scripts and files appears in a different typeface and is highlighted in gray with a border around it.

**Boldface text should be located on one line instead of on multiple lines as shown in the samples; formatting in this document prohibits correct usage.**

Comments included in the scripts are listed in blue font for explanation purposes and marked with comment markers (#) so that the code can be copied and pasted.

## Required hardware and software

This section describes hardware and software requirements mandated for PXE functionality.

### For the PXE server

Setting up a Linux PXE server requires an HP ProLiant server and two key software components that provide basic PXE functionality: (1) the DHCP server and (2) the TFTP server. Although the DHCP server and the TFTP server components can reside on separate servers, this paper describes a method that places these components on the same server.

For a PXE server to be useful, additional server software is required such as NFS, FTP, HTTP, and Samba. Pxelinux allows further configuration based on a directory and configuration files versus modifying the dhcpd.conf file directly when using the DHCP and TFTP server components alone. The additional file sharing services can reside on the same PXE server or can exist as a separate server on the network. The described method in this paper places NFS and FTP on the same PXE server.

The PXE portion will be handled by the syslinux package. The Syslinux 1.75 package included in Red Hat Linux 8.0 is broken; therefore, version 2.00 or later should be used.

### For the clients

The clients must have a PXE-enabled network interface controller (NIC). To integrate the clients with the PXE server, this paper describes a process using a kickstart file.

## Overview

This section presents an overview for using the pxelinux process and kickstart files.

### pxelinux functionality

The pxelinux functionality occurs in this order:

- The client machine boots to PXE which requests a DHCP address.
- The DHCP server responds with an IP address for the client machine along with the address of a TFTP server and a filename to load (pxelinux.0) from that server.
- The client then downloads pxelinux.0 from the specified TFTP server and executes it.
- pxelinux.0 then searches the pxelinux.cfg directory on the server for a configuration file that matches the IP address of the machine. If no matches are found, it will attempt to load a file called default.
- The configuration file loaded by pxelinux.0 will have instructions on what to do next. Some of the choices include boot to local hard drive, boot to an image file (floppy image), or load vmlinuz and initrd.img.

The client searches for a configuration file with the IP address converted to HEX (for example, 172.48.1.253 becomes AC3001FD). In this example, the client looks for the following configuration file names and uses the first one it finds.

```
AC3001FD
AC3001F
AC3001
AC300
AC30
AC3
AC
A
default
```

This process allows IP groups to be used. The examples in this paper use AC3001FD, the most specific choice.

## Kickstart files

An automated installation of Red Hat Linux is performed through a process called kickstart. A kickstart file is a collection of instructions and keywords that the Red Hat Linux installer, called anaconda, uses to perform an unattended install.

Often a kickstart file is created by using the program called `redhat-config-kickstart` or `ksconfig` which is used by older versions of Red Hat Linux. Anaconda also places a kickstart file in the `/root` directory upon installation completion.

---

### Note

For more information about anaconda, visit <http://rhlinux.redhat.com/anaconda/>.

---

A kickstart file, commonly labeled `ks.cfg`, may be placed in several locations so that anaconda can find it. These locations include being placed on an NFS server, FTP server, HTTP server, floppy, CD-ROM, or hard drive. The method described in this HOWTO places the `ks.cfg` file on an NFS server.

The method described in this HOWTO assumes that the `syslinux/pxelinux` package will be used on Red Hat Linux 8.0 to allow the clients to boot to PXE.

## Setting up the PXE server

Follow these steps to set up the PXE server:

1. Install Red Hat Linux 8.0 on a suitable HP ProLiant server.

---

### Note

Refer to the ProLiant server certification matrix, <http://h18000.www1.hp.com/products/servers/linux/hpLinuxcert.html>, to determine a suitable server for Red Hat Linux 8.0.

---

2. Install the following packages:

**Table 1.** Recommended packages

Package name	Requirements
<code>dhcp-3.0pl1-9.i386.rpm</code>	Required
<code>tftp-server-0.29-3.i386.rpm</code>	Required
<code>tftp-0.29-3.i386.rpm</code>	Optional

3. Set up the date and time on the PXE server.

4. Set up the PXE server hostname.

- Use this method for a static IP address when modifying `/etc/hosts`:

```
127.0.0.1 localhost.localdomain localhost
172.48.0.1 pxel.pxe.net pxel
```

- Use this method for a dynamic IP address when modifying `/etc/hosts`:

```
127.0.0.1 pxel.pxe.net localhost.localdomain localhost pxel
```

- After updating `/etc/hosts`, run the `hostname` command to change the hostname:

```
hostname pxel.pxe.net
```

- Edit the `/etc/sysconfig/network` as follows:

**Static:**

`NETWORKING=yes`

`HOSTNAME="pxel.pxe.net"`

**Dynamic:**

`NETWORKING=yes`

`HOSTNAME="pxel.pxe.net"`

`DHCP_HOSTNAME="pxel.pxe.net"`

5. Set up the DHCP service.

- A sample `/etc/dhcpd.conf` configuration file is located at `/usr/share/doc/dhcp-3.0pl1/dhcpd.conf.sample`. Copy this sample to `/etc/dhcpd.conf`.
- If more than one network card resides in the DHCP server, HP recommends specifying which interfaces the DHCP server will use. Edit `/etc/sysconfig/dhcpd` by adding the appropriate interface to the `DHCPDARGS=` line. The entry in `/etc/sysconfig/dhcpd` should appear as follows:

`DHCPDARGS=eth0`

- Run the following command to ensure that the DHCP service will be started at each boot:

```
chkconfig --level 345 dhcpd on
```

6. Configure xinetd and TFTP services. At this point, the TFTP server should be installed.

- Enable the TFTP server by using the `chkconfig` command line utility as follows:

```
chkconfig tftp on
```

- Ensure that `xinetd` is enabled, as TFTP is started and stopped by `xinetd`, using the following command:

```
chkconfig --level 345 xinetd on
```

- Notify `xinetd` that the TFTP service has been enabled. Use the following command:

```
service xinetd restart
```

7. Add the `next-server` and `filename` options into the `/etc/dhcpd.conf` files. To accomplish this task, add the following to the global section:

```
if substring (option vendor-class-identifier, 0, 9) = "PXEClient"
{
    filename "pxelinux.0";
    next-server 172.48.0.1;
}
```

8. **Optional step:** Assign fixed addresses to each of the clients. The benefit is having the ability to access the clients with the same IP address. The alternative is to use name resolution such as DNS:

```
host 00080246e75d {
    hardware ethernet 00:08:02:46:e7:5d;
    fixed-address 172.48.1.253;
}
```

In this example, the server was named according to its MAC address. Its MAC address is listed along with the fixed IP address we want associated with it.

9. After modifying `/etc/dhcpd.conf`, notify the dhcpd server of the changes by using the following method or a similar one:

```
service dhcpd restart
```

---

#### Warning

Do not run a new DHCP server on a network with an existing one unless you have configured the network for multiple DHCP servers. Running two or more DHCP servers on the same network without taking special precautions causes conflicts.

---

10. Download and install Syslinux 2.00 or later as follows:

---

#### Note

HP recommends using [Syslinux 2.00 or later](#) due to major bug fixes in this version. Red Hat Linux 8.0 includes Syslinux 1.75.

---

- Download and unpack the latest syslinux package from [www.kernel.org/pub/linux/utils/boot/syslinux/RPMS](http://www.kernel.org/pub/linux/utils/boot/syslinux/RPMS).
- Install the syslinux package using this command:

```
rpm -hUv syslinux-2.02-1.i386.rpm
```

- Install pxelinux.0 and memdisk into the `/tftpboot` directory:

```
mkdir -p /tftpboot/pxelinux.cfg
cp -a /usr/lib/syslinux/pxelinux.0 /tftpboot/
cp -a /usr/lib/syslinux/memdisk /tftpboot/
```

11. Enable NFS on the server as follows:

- Edit `/etc/exports` by adding the following line:

```
/var/ftp/pub          *(ro,insecure,sync,all_squash)
```

- Enable the NFS server on boot by using the following commands:

```
chkconfig --level 345 portmap on
chkconfig --level 345 nfslock on
chkconfig --level 345 nfs on
```

- Start or restart the NFS service by using the following commands:

```
service portmap restart
service nfslock restart
service nfs restart
```

## Integrating the clients

The following examples explain how to get a Red Hat Linux 8.0 client setup and integrated into the PXE server. When using other Linux distributions, slight changes to the commands and scripts are required.

1. Populate the NFS server with Linux installation files using either of the following methods:

### **Method 1: storing the Linux installation media as ISO images**

To use RHupdate with this method, place the updates.img file next to the ISO images.

To perform an ISO image dump, use the following commands:

---

#### **Note**

It is not necessary to mount each CD after insertion. The dd command is not affected by the act of mounting the CD.

---

```
mkdir -p /var/ftp/pub/rhl80
cd /var/ftp/pub/rhl80
insert CD #1
dd if=/dev/cdrom of=Psyche-i386-disc1-boxset.iso
insert CD #2
dd if=/dev/cdrom of=Psyche-i386-disc2-boxset.iso
insert CD #3
dd if=/dev/cdrom of=Psyche-i386-disc3-boxset.iso
```

### **Method 2: unpacking the Linux installation media to a directory**

To use RHupdate with this method, place the updates.img file image in the RedHat/base/ directory. Alternatively, you may place the contents of the updates.img file image into the RedHat/RHupdates/ directory of the unpacked source media. Unpacking the source media will also allow for updated RPMs.

Since Red Hat Linux 7.2 and Red Hat Linux Advanced Server 2.1 cannot use ISO images to perform installs, the contents of the CDs must be unpacked to a directory on the server to enable the automated installs described in this document.

To unpack the base media to a directory, choose one of the following options:

#### Option 1: dumping from ISO images

```
mkdir -p /var/ftp/pub/rhl72/i386
cd /var/ftp/pub/rhl72
for X in enigma-i386-disc1.iso enigma-i386-disc2.iso; do
    mkdir $X.dir;
    mount $X $X.dir -o loop;
    (cd $X.dir && tar -cf - .)|(cd i386 && tar -xvf -);
    umount $X.dir;
    rmdir $X.dir;
done
```

## Option 2: dumping directly from CD-ROM

```
mkdir -p /var/ftp/pub/rhl72/i386
```

Use the following command for each binary CD:

```
(cd /mnt/cdrom && tar -cf - .)| (cd /var/ftp/pub/rhl72/i386 && tar -xvf -); eject
```

2. Place the kickstart file on the NFS server along with Red Hat Linux 8.0 ISO images 1, 2, and 3 to ensure that the kickstart installation can operate correctly.

```
mkdir /var/ftp/pub/kickstart
```

```
cp ks.cfg /var/ftp/pub/kickstart/rhl80-ks.cfg
```

---

### Note

A kickstart file is generated after installation or the redhat-config-kickstart program may be run. Older versions of Red Hat Linux use ksconfig.

The kickstart file provided in Appendix b has been tested and works with Red Hat Linux 7.2, Red Hat Linux 7.3, Red Hat Linux 8.0, and Red Hat Enterprise Linux 2.1.

If a required keyword for the specified Linux distribution is missing, the installation will stop and wait for user input at the console.

---

3. Populate the PXE server with items to boot from.

In this client example, we will perform a Red Hat Linux 8.0 installation. Most files will be placed into the /tftpboot directory and syslinux.cfg will be placed in /tftpboot/pxelinux.cfg. With the Red Hat 8.0 Linux CD-ROM and bootnet.img floppy inserted, perform the following commands:

```
cp -a /mnt/cdrom/images/bootnet.img /tftpboot/rhl80-bootnet.img
cd /mnt/floppy
cp -a syslinux.cfg /tftpboot/pxelinux.cfg/rhl80-syslinux.cfg
```

All other files are stored in the /tftpboot directory:

```
cp -a initrd.img /tftpboot/rhl80-initrd.img
cp -a vmlinuz /tftpboot/rhl80-vmlinuz
for X in *.msg; do cp -a $X /tftpboot/rhl80-$X; done
```

The initrd.img and vmlinuz can also be copied from the /images/pxeboot directory of Red Hat Linux 8.0 CD #1 rather than from the bootnet floppy. The vmlinuz from /images/pxeboot is an exact copy of the one on the bootnet floppy. The initrd.img file contains more drivers than the bootnet.img file.

Ensure that the permissions on /tftpboot allow anonymous access by using this command:

```
chmod -R o=rx /tftpboot
```

4. Edit the /tftpboot/pxelinux.cfg/rhl80-syslinux.cfg configuration file so that the filenames match those in the /tftpboot directory. The following commands used in vi are helpful to make these global changes in the rhl80-syslinux.cfg file:

```
:%s/ \(.msg\) / rhl80-\1/g
:%s/kernel \(.vmlinuz\) /kernel rhl80-\1/
:%s/ \(\initrd=\) \(.initrd.img\) / \1rhl80-\2/
```

Once the previous steps are complete, the following directory structure will exist:

- /tftpboot/
- /tftpboot/pxelinux.0
- /tftpboot/rhl80-vmlinuz
- /tftpboot/rhl80-initrd.img
- /tftpboot/pxelinux.cfg/
- /tftpboot/pxelinux.cfg/rhl80-syslinux.cfg

---

**Note**

Run the "import-to-tftpboot.sh" script located in Appendix b to automatically accomplish the tasks described this step.

---

5. A configuration file must be created to control what happens when the PXE client boots to PXE.

As an example, we will create the `rhl80-kickstart-install-syslinux.cfg` file by copying it from `rhl80-syslinux.cfg` using the following command:

```
cp -a rhl80-syslinux.cfg rhl80-kickstart-install-syslinux.cfg
```

A sample of the file contents is located in Sample 2 of Appendix b.

6. Create a soft link from the `syslinux.cfg` file to the IP address of the client server, which is converted to HEX. In this example, the client server, 172.48.1.253, converted to HEX is AC3001FD. Use these commands to create the soft link:

```
cd /tftpboot/pxelinux.cfg
ln -s rhl80-kickstart-install-syslinux.cfg AC3001FD
```

Another acceptable soft link to create is one named "default." The use of the default entry affects any clients that may PXE boot and do not have a specific HEX IP address entry in `/tftpboot/pxelinux.cfg`. In the following example, we demonstrate linking the sample "localboot-syslinux.cfg" to a soft link called "default":

```
cd /tftpboot/pxelinux.cfg
ln -s localboot-syslinux.cfg default
```

A sample `syslinux.cfg` is included in Appendix b.

7. Boot the client to PXE to begin kickstart installation.

PXE is often the fourth choice in the boot order list. If no bootable media is found in the floppy, CD-ROM drive, or hard drive, it will default to PXE. If the hard drive has been partitioned, it may no longer default to PXE even though the hard drive is not bootable. In some large cluster farms, boot to PXE is moved to the top of the boot order. Then the PXE server, through the use of soft links in the `/tftpboot/pxelinux.cfg` directory, controls whether the client loads a new operating system or if the client boots to its hard drive.

Alternative methods include:

- Press **F12** during POST to boot to PXE.
- If the HP Server Management Drivers and Agents (hpasm) are loaded on the server being reprovisioned, set the server to a one-time PXE boot by typing:

```
/sbin/bootcfg -P
```

This setting allows for changes in the boot process without updating the BIOS or the need to press F12.

---

**Note**

For bootcfg usage information, refer to the "Troubleshooting" section.

---

## Troubleshooting

This section contains usage information, potential issues, and additional configuration steps to aid in troubleshooting.

### Bootcfg usage information

Usage commands for bootcfg include:

```
[root root]# bootcfg -?
USAGE: bootcfg [-F -C -H -T] [-S -Q -R -P] [-r -d -n -b]
    -D Set Defaults everywhere
    -F Floppy first
    -C CD ROM first
    -H Harddrive first
    -T Tape first
    -S one time boot to system configuration utility
    -Q one time boot to quick configuration utility
    -R one time boot to RBSU
    -P one time boot to PXE
    -r one time remote
    -d one time remote dial out
    -n one time remote network
    -b bypass F1/F2
```

### Potential kickstart installation issues

Kickstart installations might fail due to the client system being unable to mount the NFS directory that contains the ks.cfg file. The client will report "cannot find ks.cfg" on the console to the user. This error can be viewed on the NFS server by looking at /var/log/messages or virtual terminal #3 on the client.

Receiving an unauthenticated mount in which the server cannot do a reverse lookup on client IP to compare it to the "permissions" string in /etc/exports is also possible. To correct this issue, either add the client IPs to the /etc/hosts of the NFS server or define them in DNS for proper reverse lookups. Add appropriate lines to the dhcpd.conf file to notify the client about the location where DNS and gateway services reside.

```
option domain-name          "testnetwork.com";
option domain-name-servers  172.48.0.1, 172.48.0.2;
option routers               172.48.0.51;
```

A faster verification alternative is to use the IP subnet information in /etc/exports instead of "\*" so that the server will not try the reverse lookup.

## Additional configuration for ProLiant BL10e servers

The following changes are recommended to optimize the serial port on ProLiant BL10e servers:

1. Display the Linux boot sequence on the serial port and on screen #1. Add "console=ttyS0,115200 console=tty1" to the boot loader.
2. Force a safe probe on startup of the serial port. Change "SAFE=no" to "SAFE=yes" in /etc/sysconfig/kudzu.
3. Display the login prompt on the serial port. Add "s0:12345:respawn:/sbin/agetty 115200 ttyS0 vt100" to /etc/inittab.
4. Allow root to login on the serial port. Add "ttyS0" to /etc/securetty.

To automate the above process, place the following script in the %post section of the kickstart file:

```
##
## Configure LILO/GRUB to show Linux Boot Sequence on both the Serial
## Console (ttyS0) and Screen #1 (tty1)
##
if [ -f /etc/lilo.conf ]; then
    DEFAULT=`cat /etc/lilo.conf | grep default`
    mv /etc/lilo.conf /etc/lilo.conf.sav
    cat /etc/lilo.conf.sav | awk
    "{gsub(\"$DEFAULT\", \"\\$DEFAULT\\nappend=\\\"console=ttyS0,115200
    console=tty1\\\"\\n\"); print}" >/etc/lilo.conf

    /sbin/lilo
fi

if [ -f /boot/grub/grub.conf ]; then
    mv /boot/grub/grub.conf /boot/grub/grub.conf.sav
    cat /boot/grub/grub.conf.sav | awk '{if ($1 ~ /kernel/){print $0
    " console=ttyS0,115200 console=tty1"} else {print}}' > /boot/grub/grub.conf
fi

##
## Do KUDZU serial fix by making serial port "safe" (SAFE=yes) ##
mv /etc/sysconfig/kudzu /etc/sysconfig/kudzu.sav
cat /etc/sysconfig/kudzu.sav | sed -e 's/^[sS][aA][fF][eE]=.*/SAFE=yes/' >
/etc/sysconfig/kudzu

##
```

```
## Show login prompt on serial port
##
mv /etc/inittab /etc/inittab.sav
cat /etc/inittab.sav | awk '{gsub("6:2345:respawn:/sbin/mingetty
tty6","6:2345:respawn:/sbin/mingetty tty6\ns0:12345:respawn:/sbin/agetty 115200
ttyS0 vt100"); print}' >> /etc/inittab

##
## Allow root to login on the serial port
##
cat /etc/securetty | grep "^ttyS0" >/dev/null || echo ttyS0 >> /etc/securetty
```

## Appendix a: glossary

In this glossary, terms are listed alphabetically with detailed descriptions for each entry.

**Table 3.** Glossary terms<sup>1</sup>

Term	Definition
Dynamic Host Configuration Protocol (DHCP)	DHCP is a protocol used for assigning dynamic IP addresses to a device on a network. DHCP simplifies network administration because the software keeps a log of IP addresses it hands out dynamically. By this action, it allows an administrator to add computers to a network without the hassle of manually assigning a unique IP address each time.
Dynamic IP Address	A dynamic IP address is an address dynamically assigned by the DHCP server. As the name implies, dynamic addressing most often uses a different IP address each time the computer or network device requests an IP address from the DHCP server. The computer or network device will use this assigned IP address until it is turned off.
Fixed IP Address	A fixed IP address takes the best attributes of both the dynamic and static IP address schemes. In this case, the DHCP service supplies the server with an address that never changes. This assignment eliminates the need to manually configure a static IP address on the server and allows that same network device to be moved easily into an environment that participates in DHCP addresses. This flexibility allows a network device with a fixed IP address to participate on a network using a dynamic IP address without additional configuration on the client side.
IP Address Conflict	It is important for each computer or network device participating on a single network to have distinct IP addresses. When two computers or network devices have the same IP address then a conflict is created and one or both systems will have network problems. Automatically configuring IP addresses through a single DHCP server aids in preventing IP address conflicts.
Media Access Control (MAC) Address	The MAC address is your network card's unique hardware number. This MAC address usually is not used directly. It is often paired with an IP address which is then used to communicate with that computer or network device.
Static IP Address	A static IP address is a permanent IP address (an address that does not change). This address is manually configured, for example, it is not distributed by a DHCP server. The network administrator usually controls which static IP addresses are in use and who is able to use them.

<sup>1</sup> Networking Glossary of Terms. U.S. Robotics. 25 July 2003.  
<[www.usr.com/education/networkingqglossary.asp](http://www.usr.com/education/networkingqglossary.asp)>

## Appendix b: sample scripts and files

### For the PXE server

This section includes sample configuration files as a reference for the PXE server examples provided throughout the HOWTO.

#### NFS configuration file

A typical NFS configuration file, `/etc/exports`, is similar to the following.

```
/var/ftp/pub *(ro,insecure,sync,all_squash)
```

To start the NFS server at the next boot, type the following lines at the command prompt:

```
chkconfig --level 345 nfs on
chkconfig --level 345 nfslock on
chkconfig --level 345 portmap on
```

To start the services now instead of rebooting, type the following lines at the command prompt:

```
service nfs start
service nfslock start
service portmap start
```

#### syslinux.cfg files

Four sample `syslinux.cfg` files are provided in this section.

##### Sample 1

This script, filename "`rh180-interactive-install-syslinux.cfg`," performs an interactive installation, requiring user interaction.

```
# Install Red Hat 8.0
default linux
prompt 1
timeout 600
display rh180-boot.msg
F1 rh180-boot.msg
F2 rh180-options.msg
F3 rh180-general.msg
F4 rh180-param.msg
F5 rh180-rescue.msg
F7 rh180-snake.msg
label linux
    kernel rh180-vmlinuz
    append initrd=rh180-initrd.img lang= devfs=nomount ramdisk_size=9216
...
```

### Sample 2

This script, filename "rh180-kickstart-install-syslinux.cfg," performs an automated installation using a kickstart file.

```
# Install Red Hat 8.0 via kickstart file

default ks

prompt 1

timeout 20

display rh180-boot.msg

...

label ks

    kernel rh180-vmlinuz

    append ks=nfs:172.48.0.1:/var/ftp/pub/kickstart/rh180-ks.cfg initrd=rh180-
initrd.img lang= devfs=nomount ramdisk_size=9216 ksdevice=eth0

...
```

### Sample 3

This script, filename "rh180-bootnet.img-syslinux.cfg," explains how to use a boot image to the server.

```
# Boot to a disk image (bootnet.img)

default rh180-bootnet.img

prompt 1

timeout 600

...

label rh180-bootnet.img

    kernel memdisk

    append initrd=rh180-bootnet.img

...
```

### Sample 4

This script, filename "localboot-syslinux.cfg," tells the server to boot locally.

```
# Perform a local boot

default localboot

prompt 1

timeout 20

...

label localboot

    localboot 0

...
```

### import-to-tftpboot.sh file

The "import-to-tftpboot.sh" script imports a bootnet.img floppy into the /tftpboot directory and automatically renames the files based on the given name.

```
#!/bin/sh

TFTPBOOTDIR=/tftpboot
PXELINUXDIR=$TFTPBOOTDIR/pxelinux.cfg
TMPDIR=/tmp

if [ -z "$2" ]; then echo This code will unpack a floppy image from location SOURCE
into /tftpboot and will rename using the specified name; echo Usage: $0 SOURCE
NAME; exit; fi

SOURCE=$1
NAME=$2

# Create pxelinux.cfg directory if it does not exist.
if [ ! -d $PXELINUXDIR ]; then mkdir -p $PXELINUXDIR; fi

copyfiles()
{
# This section copies and renames all files except syslinux.cfg.
FILES=`ls | grep -v syslinux.cfg`

for X in $FILES; do cp -a $X $TFTPBOOTDIR/$NAME-$X; done

# This section copies/renames syslinux.cfg and modifies it to point
# correctly to the other copied/renamed files.
for X in `ls | grep syslinux.cfg`; do
sh <<-EOF > $PXELINUXDIR/$NAME-$X
`echo -ne "cat $X | sed"
for Y in $FILES; do
echo -ne " " -e \"s,{Y}$\|${Y}[^=],$NAME-&,g\""
done`
EOF
done
}

# This section attempts to locate the specified files for copying purposes.
if [ -d $SOURCE ]; then
if [ `ls $SOURCE | wc -l` -eq 0 ]; then
# If SOURCE dir is empty, then attempt to mount that dir.
mount | grep $SOURCE ||
{
mount $SOURCE >/dev/null 2>&1 && {
cd $SOURCE
copyfiles
cd /
umount $SOURCE
}
```

```

    } || {
        echo Unable to mount that directory, no files found
    }
}
else
    # SOURCE dir is not empty, try to copy those files.
    cd $SOURCE
    copyfiles
fi
else
    # This is not a directory.
    FILETYPE=`file $SOURCE`
    case "$FILETYPE" in
# "x86 boot sector, system SYSLINUX, FAT (12 bit)"
*boot\ sector,\ system\ SYSLINUX,\ FAT\ *)
        mkdir $TMPDIR/tmp.dir.$$;
        mount $SOURCE $TMPDIR/tmp.dir.$$ -o loop;
        cd $TMPDIR/tmp.dir.$$;
        copyfiles;
        cd /;
        umount $TMPDIR/tmp.dir.$$;
        rmdir $TMPDIR/tmp.dir.$$;
        ;;
*)
        echo Sorry, image type not found;
        ;;
esac
fi

```

## For the clients

Sample scripts and files to be used as guidelines for creating your own are provided in this appendix. These scripts and files are a necessary part of the PXE installation process.

### dhcpcd.conf script

A typical "dhcpcd.conf" script for Red Hat Linux 8.0 is similar to the following:

```

ddns-update-style interim;
ignore client-updates;
# This is an upstream network required entry for multiple networks.
subnet 10.10.20.0 netmask 255.255.255.0 {
}

# Pxe Network
subnet 172.48.0.0 netmask 255.255.0.0 {

# --- default gateway
option routers    172.48.0.1;

```

```

option subnet-mask 255.255.0.0;

option nis-domain "domain.org";
option domain-name "domain.org";
option domain-name-servers 172.48.0.1,10.10.20.242;

# PXE-specific configuration directives global section
if substring (option vendor-class-identifier, 0, 9) = "PXEClient"
{
filename "pxelinux.0";
next-server 172.48.0.1;
}

option time-offset -21600; # Central Standard Time
option ntp-servers 172.48.0.1;
#option netbios-name-servers 172.48.1.1;
# --- Selects point-to-point node (default is hybrid).
# --- Don't change this unless you understand Netbios very well
#option netbios-node-type 2;

range dynamic-bootp 172.48.0.128 172.48.0.255;
default-lease-time 21600;
max-lease-time 43200;

host 00080246e75d {
hardware ethernet 00:08:02:46:e7:5d;
fixed-address 172.48.1.253;
# PXE-specific configuration directives client specific section
next-server 172.48.0.1;
filename "pxelinux.0";
}
host 00508bea8000 {
hardware ethernet 00:50:8b:ea:80:00;
fixed-address 172.48.1.254;
# etherboot-specific configuration directives
next-server 172.48.0.1;
filename "etherboot.img";
}
}

```

### syslinux.cfg script

A typical "syslinux.cfg" file for Red Hat Linux 8.0 is similar to the following. This script controls which kernel, initrd, and kickstart files are used to boot the PXE clients.

```
default ks
prompt 1
timeout 20
display rh180-bootnet.img-boot.msg
F1 rh180-bootnet.img-boot.msg
F2 rh180-bootnet.img-options.msg
F3 rh180-bootnet.img-general.msg
F4 rh180-bootnet.img-param.msg
F5 rh180-bootnet.img-rescue.msg
F7 rh180-bootnet.img-snake.msg

label ks
    kernel rh180-bootnet.img-vmlinuz
    append ks=nfs:172.48.0.1:/var/ftp/pub/kickstart/rh180-ks.cfg
    initrd=rh180-bootnet.img-initrd.img lang= devfs=nomount ramdisk_size=9216
    ksdevice=eth0

# Perform a boot to local media; for example, exit pxe.
label localboot
    localboot 0

# Boot to an image file such as a boot floppy.
label rh180-bootnet.img
    kernel memdisk
    append initrd=rh180-bootnet.img
```

### Kickstart file

A typical "kickstart" file generated by Kickstart Configurator is similar to the following. This script controls how a Red Hat Linux installation is performed.

```
# Merged from Red Hat Linux versions: 7.2, EL 2.1, 7.3, 8.0.
# Change the line nfs --server 172.48.0.1 --dir /var/ftp/pub/rh73
# to reflect the correct installation directory
# for the OS version being installed.
# Also, you may need to update the %packages section.
# System language
lang en_US
# The following are the language modules to install.
langsupport --default=en_US
langsupport en_US
# System keyboard
keyboard us
# System mouse
mouse --emulthree genericps/2
# System timezone
```

```
timezone --utc America/Chicago
# Root password
rootpw password
# Reboot after installation.
reboot
# Use text mode install.
text
# Install Red Hat Linux instead of performing an upgrade.
install
# Use NFS installation media.
nfs --server 172.48.0.1 --dir /var/ftp/pub/rh73
# System bootloader configuration
bootloader --location=mbr
# Clear the Master Boot Record.
zerombr yes
# Clear all partitions from the disk.
clearpart --all --initlabel
# Disk partitioning information
part /boot --fstype ext3 --size 75 --asprimary
part swap --recommended
part / --fstype ext3 --size 2700 --grow
# Use DHCP networking. This is only effective if ks.cfg is local.
# network --bootproto=dhcp --device=eth0
# System authorization information
auth --useshadow --enablemd5
# Firewall configuration
firewall --disabled
# Do not configure the X Window System.
skipx
# Package install information. This is for a minimal install.
%packages --resolvedeps
wget
openssh
openssh-clients
openssh-server
nfs-utils
portmap
#@Everything
%post
```

---

**Note**

To perform a full package install, uncomment the @Everything line in the kickstart file.

---

## For more information

For additional information, refer to the resources detailed below.

**Table 4.** Web resources

Resource description	Web address
<b>Linux for ProLiant website</b> contains software, hardware certification matrices, and documentation for ProLiant servers running Linux.	<a href="http://h18000.www1.hp.com/products/servers/linux/index.html">http://h18000.www1.hp.com/products/servers/linux/index.html</a>
<b>Red Hat Documentation &amp; Online Resources</b> the same guides that come with Red Hat's boxed products.	<a href="http://www.redhat.com/docs/">www.redhat.com/docs/</a>
<b>The Official Red Hat Linux Customization Guide</b> contains information on how to customize your Red Hat Linux system to fit your needs.	<a href="http://www.redhat.com/docs/manuals/linux/">www.redhat.com/docs/manuals/linux/</a>
<b>Red Hat Tips, FAQs and HOWTOs</b> contain documents to help you install, set up, and troubleshoot your Linux system.	<a href="http://www.redhat.com/apps/support/resources/">www.redhat.com/apps/support/resources/</a>

## Call to action

To help us better understand and meet your needs for ISS technology information, please evaluate this paper by completing the short survey at [www.zoomerang.com/survey.zgi?B5MB4SNPL8MA0MPTMHNE3TGC](http://www.zoomerang.com/survey.zgi?B5MB4SNPL8MA0MPTMHNE3TGC).

**Note:** This URL will be active through 30 November 2003. Please send questions and further comments about this paper to: [OSIntegrationFeedback@HP.com](mailto:OSIntegrationFeedback@HP.com).